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Role of Big Data Analytics in Agriculture and Aquafarming System

Saumya Pandey[1] and Preetam Kala[2*]

[1]PhD Scholar, Fish Genetics and Biotechnology Division, ICAR-Central Institute of Fisheries Education, Mumbai – 400061
[2]PhD Scholar, Aquaculture Department, College of Fisheries, Rangeilunda, Orissa University of Agriculture and Technology (OUAT) – 751003

*Corresponding Author
Preetam Kala*
E-mail: preetamkala@gmail.com

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INTRODUCTION

A vast data set beyond the ability of the commonly used software tools to analyse, manage and process the data within a lapsed time is termed as big data. In the recent trend the software tools became more powerful so the definition of big data also changed; today, depending on the nature and mix of the data, a set of data is considered big if it contains a few petabytes to many zettabytes of data.

Gartner IT Glossary, defined Big Data as high-volume, variety and/or high-velocity information that demands innovative forms of cost-effective information processing that enable enhanced insight, decision making, and process automation.

Broadly big data is made up of 3 V's, which are as follows:

- **Volume:** Large amounts of petabytes to zettabytes sized data.
- **Velocity:** Data streaming at a very great speed and shorter time to act based on these data streams.
- **Variety:** Data come from different data sources such as internal and external data sources. More importantly, data can come in various formats such as, structured data as a database table, semi-structured data such as XML data, unstructured data such as text, images, video streams, audio statement, and more.

A way towards smart farming

With the building blocks of the initial successes of the first Green Revolution in the 1960s, now it is high time for a new revolution in Agriculture, which is urgently needed for sustainable and significant growth in worldwide agricultural production. To achieve this, we need novel sustainable solutions to reduce the environmental footprint of farming and big data analytics.

Big Data analysis enables organizations to analyze various data sources for improved insights, which can help improve the forecasting and operational efficiency and lead to enhanced and timely decision making. These technologies, in turn, will help broaden the analytics and predictive options leading to better outcomes.

The Smart Farming concept brings alongside the management cycle as a cyber-physical system. Such a system controls the farm system, which integrates the smart devices connected to the Internet. Smart devices extend the conventional tools (e.g., rain gauge, tractor, etc.). Such extensions add autonomous context-awareness by all kinds of sensors, built-in intelligence, capable of executing autonomous actions (Wolfert et al., 2017). Human intervention is always involved in the smart farming process but at a higher intelligence level, and most of the operational activities are carried on by machines thus, cyber-physical cycle becomes almost autonomous.

Proposed multidisciplinary model for Smart Agriculture in India –

The proposed architecture of the interdisciplinary model, as shown in figure 1, consists of the five modules:

1) Sensor Kit Module
2) Mobile App Module
3) Agro Cloud Module
4) Big-Data Mining, Analysis, and Knowledge Building Engine Module
5) Government and Agro Banks User Interface

Sensor Kit module is portable Internet of Things (IoT) device with soil and environment sensors. Mobile App module provides an interface to the users. Agro Cloud Module consists of storage, Big-Data mining, analysis, and knowledge building engine and application module to communicate with the users. Government and Agro Banks user interface are a web interface for information related to agricultural schemes and loans (Channe et al., 2015).

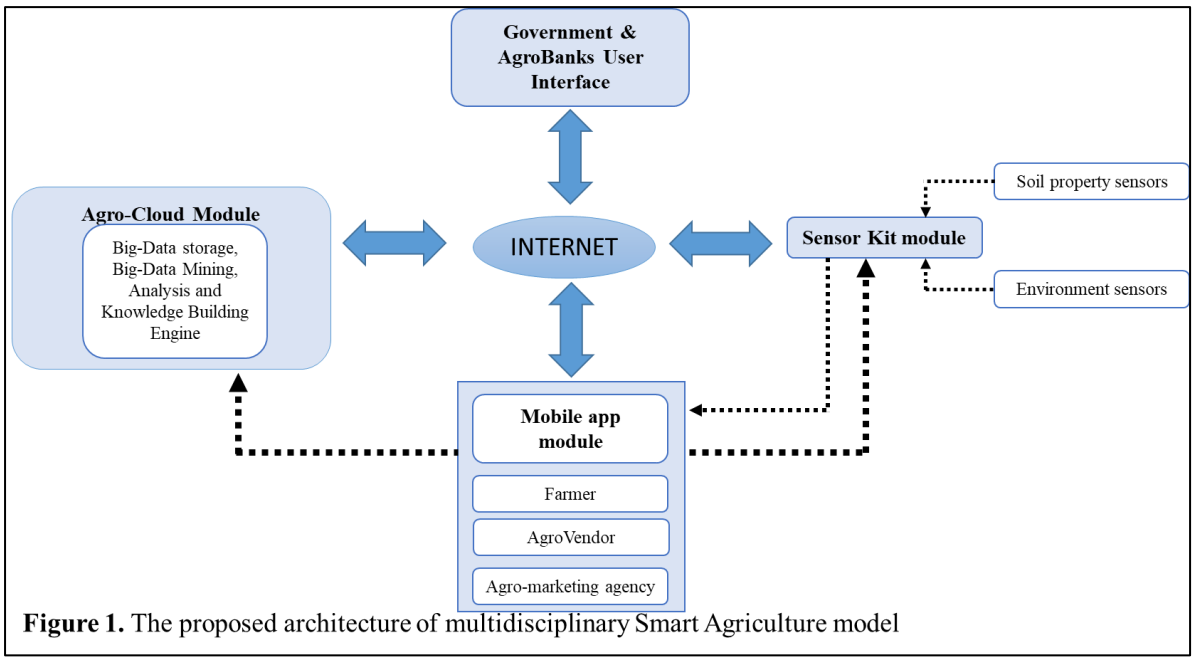

Figure 1. The proposed architecture of multidisciplinary Smart Agriculture model

Big data in fisheries

For a long time, the fish farms' performance was depended on the fish farmers' intuition and the basic conventional technologies and data tools. Due to this fundamental approach, there may often have been times where strategic knowledge may have been squandered or specific patterns in the raw data not identified.

As a direct consequence of these practices, the aquaculture industry is hampered in making optimal strategic decisions due to this lack of appropriate informed knowledge. With the recent technological advancements in cloud computing infrastructures and the availability of big datasets in the aquaculture industry, coupled with advances in modern data analytics methods, this is no longer the case. By using data analytics algorithms on datasets stored in the cloud, a backup of initial conventional intuitive decisions can be paired up with the computational model results. This can provide the industry with better decision-making tools that will further lead to increased proficiency, a better return for the farmers, and an environmental benefit through a more sustainable approach to the Aquaculture industry.

A way towards Aqua Smart farming

The main problem companies facing today is that they cannot interpret the data they capture, nor can they contemplate alternative uses for their data. So, if they were able to interpret and understand the data, they would be able to considerably improve the production in terms of food conversion ratio (FCR), cost, mortality, diseases, environmental impact, etc. Thus, the Aqua Smart project aimed to bring significant and open data analytics as a service to the aquaculture industry (Sarraipa, et al., 2016). The prime goal of the Aqua Smart project was to create a cloud-based platform to assist aquaculture managers in their decision-making process with the basics of machine learning and data mining techniques. With such platform's help, the fish farmers will have a better understanding of their farm and thus will be able to make more accurate estimations on the fish's growth (Marcelino-Jesus et al., 2018).

It allows companies to analyse production data between samplings providing them with visualisations to show new insights into what is happening on the farm. Thus, Aqua Smart aims to radically enhance the innovation capacity within the aquaculture sector by helping companies to transform the large volumes of heterogeneous captured data into knowledge through identification and analysis of this production data and subsequently using this harvested knowledge to improve performance (Sarraipa, et al., 2016).

Challenges

Privacy and security concerns regarding data sharing are some of the most significant challenges (Van't Spijker, 2014). Usually, the companies are afraid that data can fall into the wrong hands (e.g., of competitors) (Gilpin, 2015). Therefore, easy flow of technological advancements and reliable access to Big Data and building trust with farmers should be a starting point in developing applications (Van't Spijker, 2014).

CONCLUSION

In this fast-evolving era, new technological inventions are needed to enhance production sustainably. Big data analytics has been introduced as a boon to the worldwide agricultural and aquaculture farming systems. Day by day, technological advancements contribute to enhanced data production, which can be easily uploaded and analysed with the help of cloud computing and big data analytics tools. The Smart agriculture project and Aqua Smart project's main objective is to acquire new skills, knowledge, and data analytics experiences suitable for improved production efficiencies. The privacy and security concerns form the biggest challenge for the Big data analytics system. Thus, a solid and reliable open-source platform should be introduced for gaining the trust and widespread adaptability of the big data technologies.

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